

**Technical Education and Skills Development Authority
Automotive Servicing**

Automotive Servicing NC1 Reviewer

Prepared By:

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Automotive Servicing NC1 Interview Questionnaire

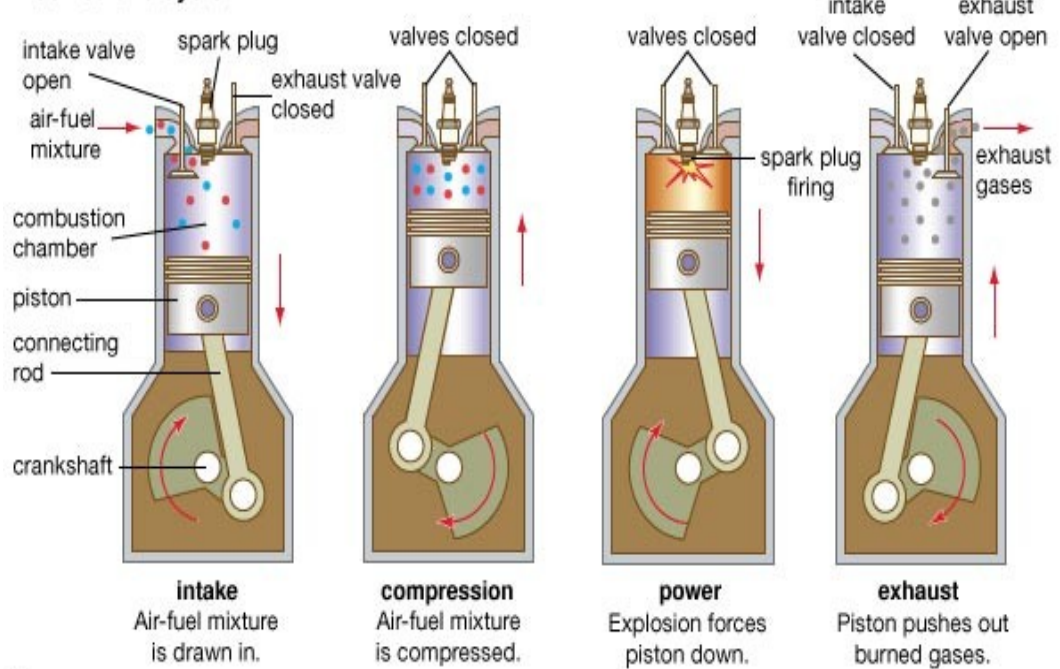
1. Explain the Four Stroke Cycle in detailed answer.
2. Identify the cooling system parts and explain its principles/ operation.
3. Identify the ignition system parts and explain its principles/ operation.
4. Enumerate some of the differences of the gasoline and diesel engines.
5. How will you determine if the ignition timing of a gasoline engine is incorrect?
6. Explain the procedures of compression testing and differentiate the wet and dry compression test.
7. What are the possible causes of compression loss and a low compression pressure?
8. Why do we have to check the static and dynamic timing? Explain its idea.
9. How will you check a misfiring problem?
10. Make a firing order chart and explain.
11. Explain why the firing order of a 4-cylinder engine is 1-3-4-2 or 1-2-4-3 and not 1-2-3-4.
12. How can you identify the Ending of compression beginning of power? P-E, E-I, I-C?
13. Why do we have to correctly adjust the valve clearance?
14. Is it normal if the oil in the engine is decreased after several distances? Why? Or Why not?
15. Give at least 4 Engine Classifications and identify its specifications.
16. Why do we have to set the 1st piston into ending of compression beginning of power before setting the pulley and the distributor assembly?
17. What is the Stoichiometric ratio of the naturally aspirated engines? Differentiate the Lean and Rich Air-fuel mixtures.
18. Why do we have to properly observe the OHS and SOP for servicing the SRS and ELR?

Desired Answers for Automotive Servicing NC1 Interview Questionnaire

1. Explain the Four Stroke Cycle in detailed answer.

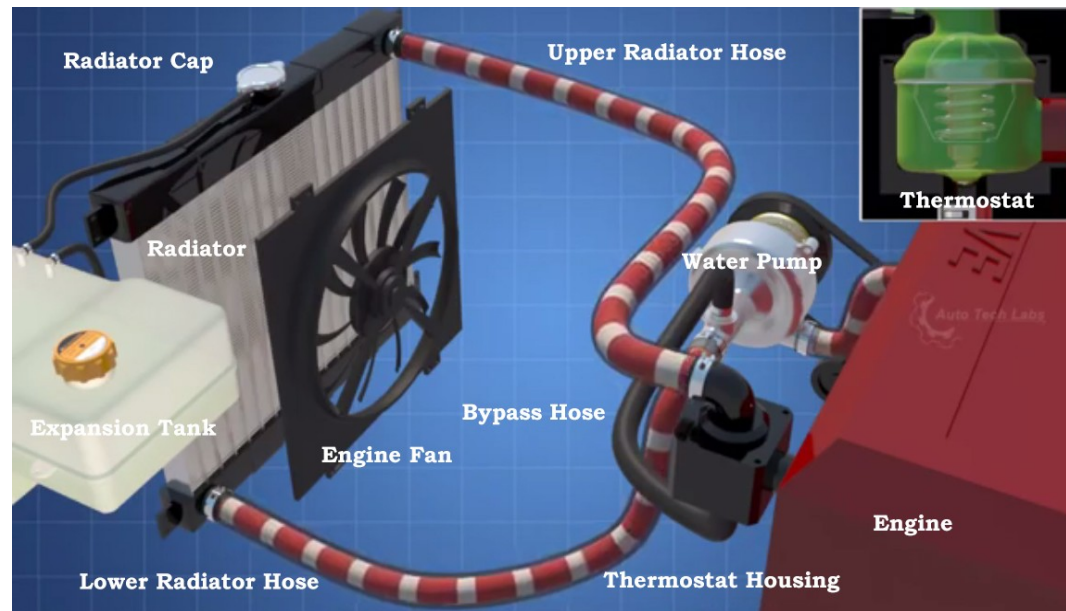
- The Four Stroke Engine is commonly used in the Automotive industry because of its several advantages versus the Two Stroke Engines, The Four Strokes Are:
 - o **Intake** – The intake Valve is open while the Exhaust Valve is close, the piston movement is downward creating vacuum enabling the Air-Fuel mixture (for Gas engine), Air only (for Diesel engine) to enter the cylinder.
 - o **Compression** – Both Valves are close, the piston movement is upward compressing the Air-fuel for Gas or Air only for Diesel, the compression pressure of gas is about 120psi to 160psi and for diesel is 220psi to 260psi.
 - o **Power** – Both Valves are close, the combustion process occurs by burning the air-fuel mixture through Spark ignition for Gasoline Engine and Compression Ignition for Diesel Engine sending the piston downward and creating a rotational movement on the crankshaft.
 - o **Exhaust** – Intake Valve is close while Exhaust Valve is open, the piston movement is upward sending the burned gases out of the combustion chamber.

Four-stroke cycle



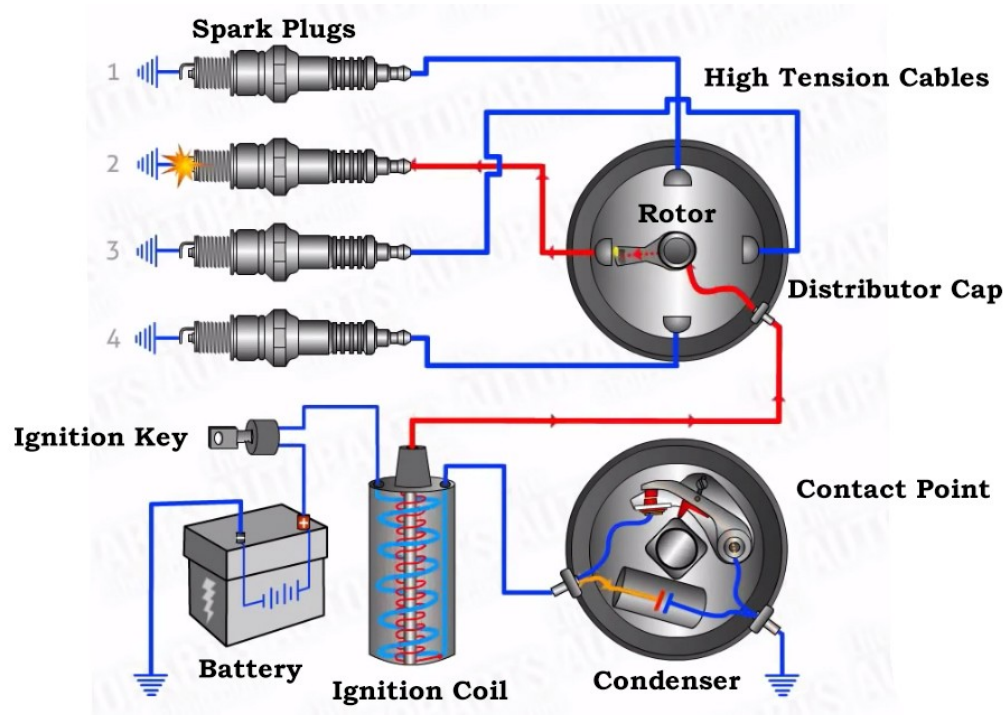
2. Identify the cooling system parts and explain its principles/operation.

- Radiator, Lower radiator hose, water pump, Water jackets, Thermostat, Coolant Temperature Sensor (CTS), Engine Fan, Bypass hose, Upper radiator hose, Radiator cap, Expansion tank, overflow hose.
 - o Cooling system does not actually cool the engine but instead, the system helps the engine get to its normal operating temperature at a short period of time and maintain it from 94°C to 114°C.
 - o The Coolant passage is changed by the thermostat, the circulation of the liquid (coolant) is different during hot and cold engine. During cold start, the coolant is recirculating from the thermostat through bypass hose, Water pump, Water jackets and back to thermostat. By the time the engine has reached its normal operating temperature, the thermostat now enables the coolant to flow through the radiator by opening the passage for the upper radiator hose.



3. Identify the ignition system parts and explain its principles/operation.

- Battery, Ammeter, Ignition Switch, Ignition Coil, Distributor Assembly, Vacuum Advancer, Contact Point, Condenser, Cam lobe, Distributor Rotor, Distributor Cap, High Tension Cables, and Spark Plugs.
 - o The Ignition system produces a sufficient amount of current to the spark plugs to ignite the air-fuel mixture. The rotor must be placed at 1°clock with the engine's 1st cylinder set into the Ending of Compression Beginning of Power, and the pulley at a 5(+2°) Before TDC or according to the manufacturer's manual.
 - o Its operation starts at the ignition coil or a Step - up Transformer with the help of a contact point. The coil energizes once the contact point is closed, and when the Cam Lobe of the distributor shaft opens the circuit of the contact point, the electromagnetic field at the coil amplifies and converts the 12V into a higher voltage up to 22 Thousand Volts which is then transferred to the tip of each spark plugs through distributor cap and rotor to produce a spark.



o So why is it 1-3-4-2?

- The ignition system follows the sequence of the Ending of Compression Beginning of Power on the engine. It is the only stroke that the spark plug will spark at a very precise timing.

4. Enumerate some of the differences of the gasoline and diesel engines.

- Gasoline and Diesel engines has similarities and differences, listed below are some of the basic differences between them. These are:
 - o Type of Fuel Used
 - Gasoline fuel for Gasoline Engine and Crude oil (Diesel fuel) for Diesel Engines.
 - o Intake and Compression stroke.
 - Air-fuel mixture is induced and compressed for Gasoline Engines while Air only is induced and Compressed on the Diesel Engines.
 - o Power
 - More power is produced using the diesel engine than the gasoline engine due to its thermal efficiency and higher compression Pressure, Stroke and Ratio.
 - o Ignition

- Spark ignition is used on all Gasoline engines and compression ignition is used on all diesel engines. These fuels must not be interchanged or it might cause a serious trouble to the engine as the fuel is specifically designed for the certain type of engine.
- o Size
 - Diesel engines are bigger than the gasoline engines because it should be able to sustain the power produced by the combustion.
- o Some major components
 - Injection pumps for diesel engines, Carburetor for gasoline engines.
 - Glow plugs for diesel engines, Spark plugs for gasoline engines.
 - Ignition system for gasoline engines.

5. How will you determine if the ignition timing of a gasoline engine is incorrect?

- A wrong ignition timing is easily determined by the performance of the engine,
 - o Engine cranks normally but will not start
 - o Rough idling
 - o Back fire
 - o After fire

6. Explain the procedures of compression testing and differentiate the wet and dry compression test.

- Compression test is a process to identify which of the engine cylinder is losing power due to a low compression pressure or loss compression.
- Before conducting a compression test, there are some things that must be considered. These are:
 - o **The Ignition system must be disabled** by disconnecting the connection on the ignition coil and the contact point, to ensure that the

engine will not run during the compression test and will not harm the compression tester and the technician.

- o **The Carburetor must be at full throttle** to let the ambient air get inside the combustion chamber freely. If the carburetor is closed, the tester will not be able to read a precise reading.
- o **The battery must be fully charged** to normally crank the engine with the appropriate speed for the compression test. If the rotation is too slow, the compression tester will not display the proper pressure readings.

- **Procedures for Dry Compression Test**

1. Check the battery voltage
2. Disable the ignition system
3. Fully open the throttle valve
4. Remove the spark plugs
5. Connect the Compression Tester one by one
6. Crank the engine for about 4-5 compression strokes
7. Take note of the readings on each cylinder

a. If the Compression Pressure is lower than the 75% of the highest compression pressure, then there must be a leakage through blow by (Worn Piston Rings) and etc.

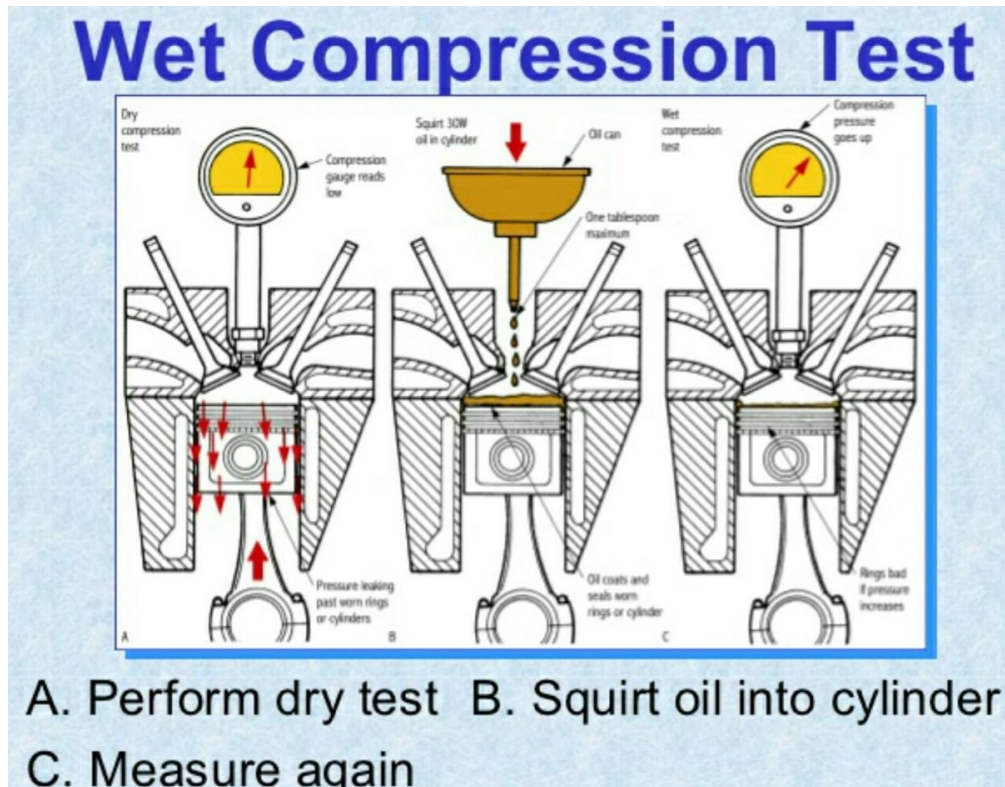
b. If the Compression Pressure is higher than the specifications, there must be a carbon deposits which will affect the engines performance or will cause a pre - ignition.

- **Procedures for Wet Compression Test**

- a. This process is almost similar to the dry compression test. Its Main Objectives is to check if there is a Blow-by on a specific Cylinder.
 - b. After the Dry Compression Test, The wet compression test is done to check if the Cylinder with a low reading has a problem with its Compression Rings.
1. Pour a 1 tbsp. of Motor Oil through the spark plug hole to temporarily Seal the worn piston rings.

2. Connect the Compression Tester

- a. If the dry compression test is low and the wet compression test is higher on a certain cylinder, it means that the piston has a blow by
- b. If the dry compression test is the same as the wet compression test, then the piston rings are good and the cause of the compression leakage is somewhere at the cylinder head, so a “Top Overhaul” is recommended.

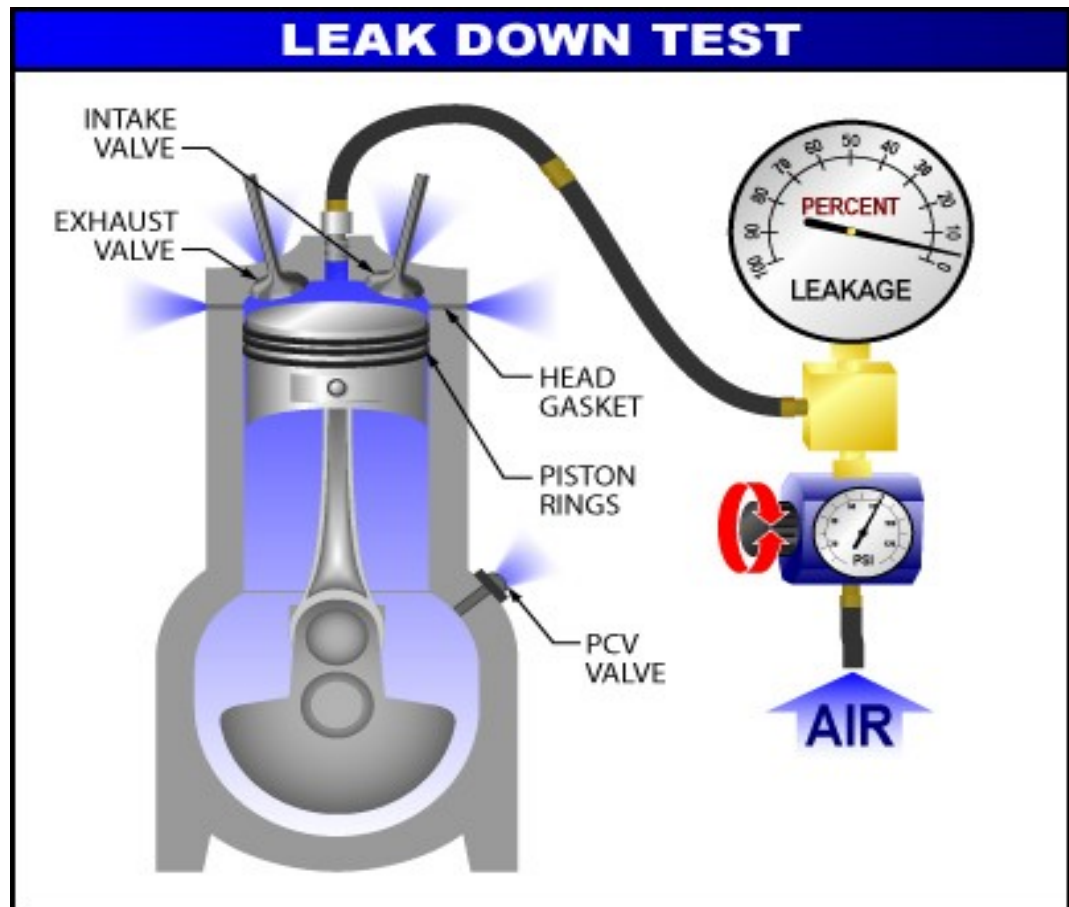


Note: NEVER perform a Wet Compression Test on a Diesel engine, the engines higher compression ratio and a larger compression pressure means a smaller combustion chamber. The Liquid is not compressible; it may cause a “Piston Lock” or “Hydro Static Lock” and may damage the starter motor and other moving and sealing parts of the engine.

7. What are the possible causes of compression loss and a low compression pressure?

- A low compression pressure is a result from a leakage inside or around the combustion chamber including some of its components. It may include the following;

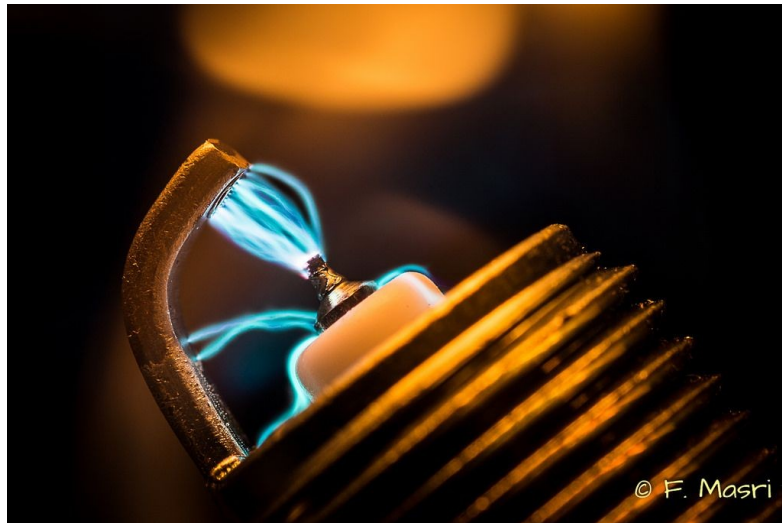
- a. Carburetor Fully Closed
- b. Low Battery Voltage
- c. Broken Valve Spring
- d. Bend Valve
- e. Burnt Valve
- f. Tight Valve Adjustments
- g. Worn Valve Seat
- h. Wrong Spark Plug Range
- i. Worn Head Gasket
- j. Worn Cylinder Lining
- k. Worn Compression Rings
- l. Blown Piston Head



8. Why do we have to check the static and dynamic timing? Explain its idea.

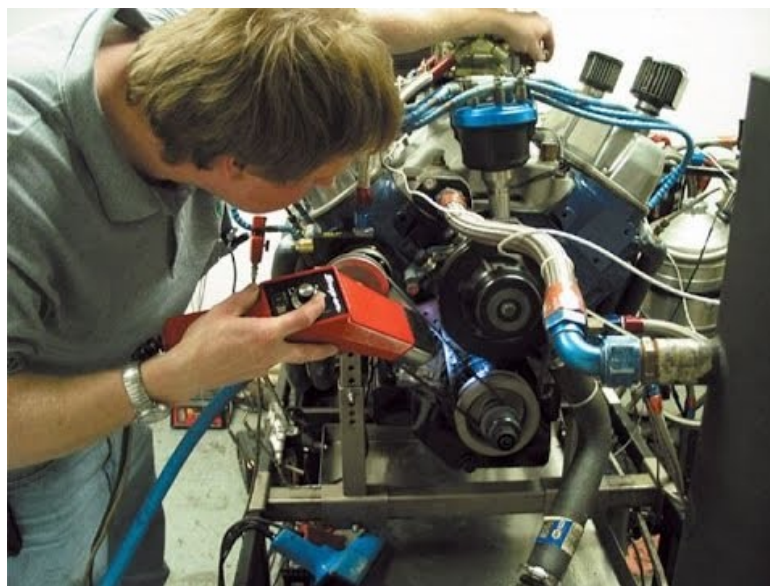
- Static Timing

- a. An engine needs a spark in every Ending of compression beginning of power, so we have to check it by static timing, while holding the ignition coil cable very close to body ground, we have to quickly rotate the distributor assembly and moving the contact point from close position to open position, so a spark will be produced on the spark plug tip and it will signify that the ignition system is working properly.



- Dynamic Timing

- a. After running the engine, we will have to set now the spark to take place at a desired angle of the engine using the Timing Light. (5° ($\pm 2^{\circ}$) for 4K engine). The Timing is not exactly at 0° because of the ignition delay.



9. How will you check a misfiring problem?

- Engine misfiring problem is a phenomenon where a cylinder is losing power due to faulty spark plugs; we can identify which of the spark plugs are faulty by performing the

“Cylinder Power Balance Test”.

- While the engine is running, we have to pull off each high tension cable connected to the spark plugs.



Note: if the Engine runs roughly after removing a cable, it means that the spark plug is functioning properly, and if the engine is not affected by the removed cable, it means that the spark plug is faulty.

The normal spark plug tip should have a slight tan deposit and electrode erosion.

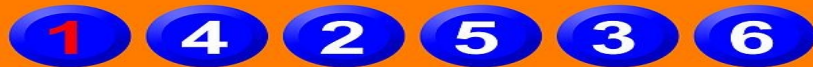
10. Make a firing order chart and explain.

- The chart is according to the firing order (1-3-4-2) and the Stroke Cycle of the Engine (I-C-P-E). The next cylinder to perform the stroke on the cylinder 1 after 180° is on 3, next is 4, next is 2, and going back to cylinder 1.

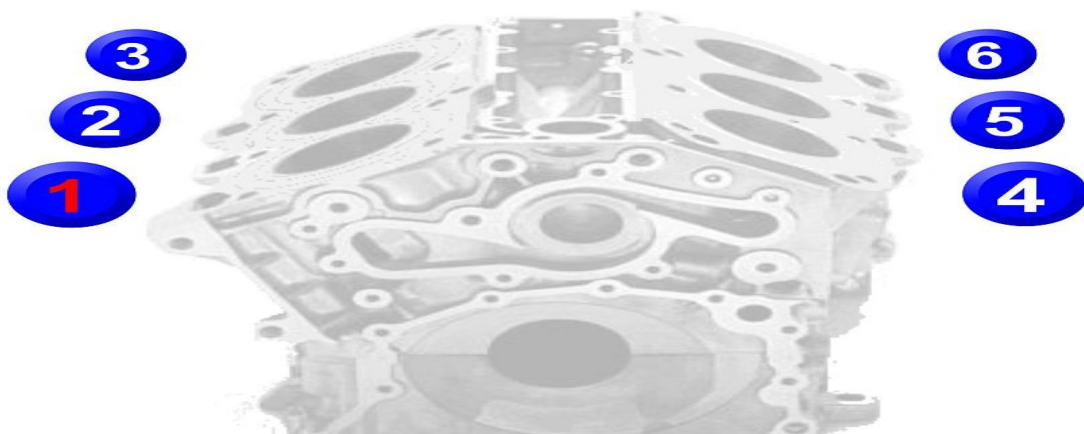
	1	2	3	4
180°	I	C	E	P
360°	C	P	I	E
540°	P	E	C	I
720°	E	I	P	C

11. Explain why the firing order of a 4-cylinder engine is 1-3-4-2 or 1-2-4-3 and not 1-2-3-4.

- The firing order of an engine is according to the sequence in which the engine will function properly without causing any excess vibrations on the vehicle.



Ford 3.0L, 3.8L and 4.0L V6
(Rear Wheel Drive)



Block Not Actual Ford

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12. How can you identify the Ending of compression beginning of power? P-E, E-I, I-C?

- Gasoline and Diesel engine tune-up is about bringing back the Engines' proper tuning for an efficient work. It is done periodically and is a part of the periodic maintenance of the automobile.
- Setting the Valve Clearance is not as easy as it looks, you shall have the ability to read and interpret the valve movement of an engine, reading the manufacturer's manual, and using the proper tools and equipment like the feeler gauge and other hand tools before conducting a valve adjustments.
- For us to find out the stroke with the Ending of Compression Beginning of Power (C-P) (red) in a four cylinder engine, we must first find its running mate. After finding its running mate, we must set it into the Ending of Exhaust Beginning of Intake (E-I) (Blue) by looking at the exhaust valve, we must rotate the engine's crankshaft clockwise and wait for the exhaust valve to open and close. It will automatically set its running mate into Ending of Compression Beginning of Power (C-P) and we can now set it valve clearance.

	1	2	3	4
180°	I-C	C-P	E-I	P-E
360°	C-P	P-E	I-C	E-I
540°	P-E	E-I	C-P	I-C
720°	E-I	I-C	P-E	C-P

- These principles can also be applied to find the other strokes.
 - To find the Ending of Intake Beginning of Compression (I-C), we can set it by rotating the Crankshaft and looking at the intake valve, we must wait for the intake valve to open and close to set it into (I-C).
 - For us to find out the stroke with the Ending of Power Beginning of Exhaust (P-E) in a four cylinder engine, we must first find its running mate. After finding its running mate, we must set it into the Ending of Intake Beginning of Compression (I-C) by looking at the intake valve, we must rotate the engine's crankshaft clockwise and wait for the exhaust valve to open and close. It will automatically set its running mate into Ending of Power Beginning of Exhaust (P-E).

13. Why do we have to correctly adjust the valve clearance?

- Preventive Maintenance Services includes valve clearance, for Toyota 4K Model Gasoline Engine, the valve clearance is 0.008" for Intake Valve and 0.012" for Exhaust Valve, for ISUZU C190 the valve clearance is 0.014" for both Intake and Exhaust Valves.
 - Too tight adjustments of valve clearance may set the valve always open and may result into loss of compression.

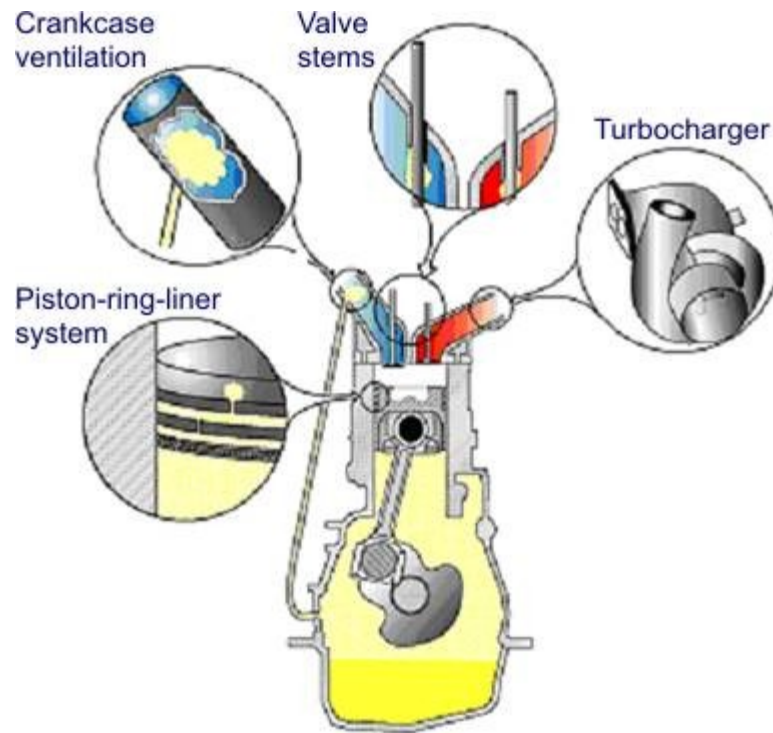


- b. Too loose valve clearance will result in a delayed opening of valves and will also cause an abnormal noise for the valves.



14. Is it normal if the oil in the engine is decreased after several distances? Why? Or Why not?

- Decreasing amount of oil is Normal. The Engine oil is needed for the lubrication of moving parts inside the vehicle, however, over time, this oil is being consumed by the combustion and other parts which have small paths for the oil to go out. Some of them are the following.



- a. Crankshaft Ventilation
- b. Valve Stems
- c. Piston ring liner system
- d. Turbo Charger

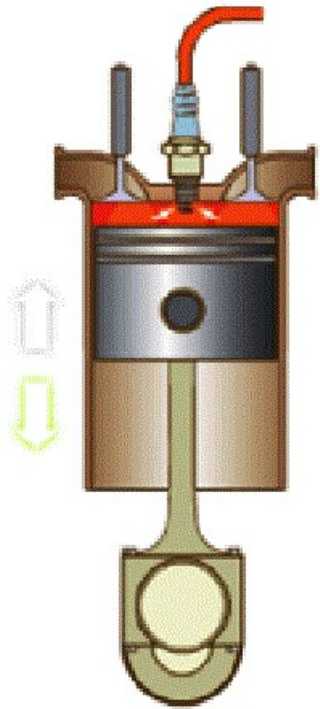
15. Give at least 4 Engine Classifications and identify its specifications.

- The engine is classified by different specifications made to the design of the engine. Some of this are the following;

- a. Cylinder arrangement. In-line, V-type, W-type, Opposed/ Flat-type, Radial Type
- b. Valve arrangements. L-type, I-type, F-type, T-type
- c. Piston Movements. Reciprocatory/ Rotary
- d. Type of Fuel used. Petrol, Diesel, Biogas, LPG, etc.
- e. According to cycle. 4 stroke, 2 stroke engines
- f. According to firing order. 1-3-4-2, 1-2-4-3 (4 Cylinder Engines), 1-2-4-5-3 (5 Cylinder Engines), 1-5-3-6-2-4 (6 Cylinder Engines), etc.
- g. Arrangements of Camshaft and Valves. SV (Side Valve), OHV (Over-Head Valve), OHC (Over-Head Camshaft), and DOHC (Double Over-Head Camshaft),
- h. Valve Mechanism. Rockerarm, Oscillating Lever, Bucket Tappet, and Roller Oscillating Lever.
- i. Camshaft Drive. Timing Gear, Timing Chain, Timing Belt, and Vertical-shaft Drive.
- j. Valve Arrangement. 2 valves, 3 Valves, 4 Valves, 5 Valves.
- k. Intake. Naturally Aspirated engines (Carbureted), Turbo charged, and Supercharged.
- l. Compression Ratio. 10:1 to 13:1 for Gasoline engine. 18:1 to 23:1 for Diesel Engines.
- m. Combustion process. Spark Ignition for Gasoline Engines, Compression Ignition for Diesel Engines.
- n. By Cooling System. Air Cooled, Water Cooled.

16. Why do we have to set the 1st piston into Ending of Compression Beginning of Power before setting the pulley and the distributor assembly?

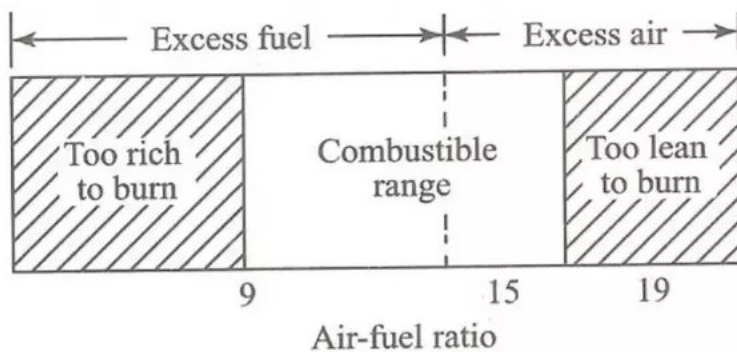
- We must first consider setting the 1st cylinder into C-P and setting the pulley at 5° (+-2°), because we would like to ignite the fuel at the 1st cylinder in this stroke, and since the rotor of the distributor is pointing directly at the 1st high tension cable when it was set at 1°clock.



- Piston Set at the Top Dead Center
- Both Valves are closed
- Ending of Compression Beginning of Power
- Spark Takes Place at exactly 5° (+/-)

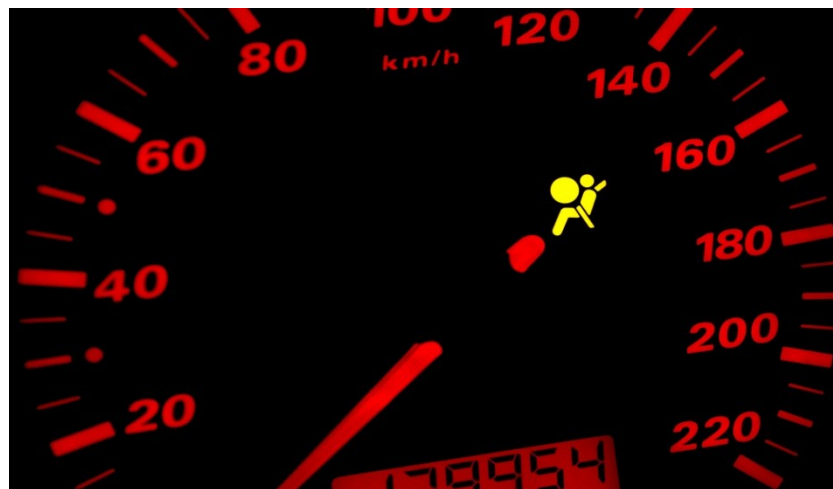
17. What is the Stoichiometric ratio of the naturally aspirated engines? Differentiate the Lean and Rich Air-fuel mixtures.

- The Stoichiometric Ratio of the Air-Fuel for the engine is 14.7lb of air is to 1lb of fuel (14.7:1).
 - If there is less air on a 1lb of fuel (below 14.7lb of air), the mixture is rich and will release a black smoke coming out of the tailpipe.
 - If there is more air on a 1lb of fuel (above 14.7lb of air), the mixture is lean and will cause a lack of power.



18. Why do we have to properly observe the OHS and SOP for servicing the SRS and ELR?

- Observing the Occupational Health and Safety (OHS) and Standard Operating Procedures (SOP) for servicing any kind of machine is a must for a technician; it will serve as safety precautions before doing a specific task on a job. It will ensure the safety not just of the technician but the vehicle itself.
 - a. In Automotive Servicing NC1, Servicing the Supplemental Restraint System (SRS) and Emergency Lock and Restraint (ELR) needs quite knowledge about the procedures to ensure that the Air bag will not explode once the job is ongoing.
 - b. Below are the procedures for removing / replacing SRS and ELR.
 1. Turn of the ignition switch.
 2. Remove the Negative Terminal Connection on the Battery.
 3. Switch the ignition key to on position and wait for 8-10mins to drain the charge of the capacitor.
 4. Proceed to removal and installation of the SRS air bag.
 5. Install the Negative Terminal Connection on the battery.
 6. Switch the ignition to on position and observe the SRS indicator on the Dashboard.



Note: There could be two possibilities after the installation of the SRS.

1. If the indicator blinks, it indicates that there is an error in the system.

2. If the indicator turned off after 5 seconds, it means that the system is installed and functioning properly.

Procedures for Gasoline and Diesel Engine Tune -up

GASOLINE ENGINE TUNE - UP

Procedures

1. Read the Manufacturer's specifications for the Engine.
2. Prepare all of the necessary tools and Personal Protective Equipment (PPE).
3. Check the Engine:
 - a. Battery Voltage
 - b. Oil Level
 - c. Run the engine for 5mins to get to its normal operating temperature.
4. Remove the Cylinder Head Cover.
5. Set the Valve Clearance for each cylinder.
 - a. Gasoline Engine: Toyota 4K/ 12R
 - i. Intake = 0.008"
 - ii. Exhaust = 0.012"
6. Set the 1st cylinder into Ending of Compression Beginning of power.
7. Set the Crankshaft pulley into 8° Before TDC.
8. Install the Distributor assembly facing 1°clock or facing the 1st high tension cable on the distributor cap.
9. Inspect the contact point clearance. 0.018"
10. Perform the Static Timing.
11. Adjust the Carburetor Settings.
 - a. The Air-fuel mixture screw is loosen 3 ½ rotations
 - b. The Idle screw is tightened 2 rotations.
12. Start the Engine.
13. Adjust the Idle screw and Air-fuel mixture properly.

14. Adjust the timing by using the timing light. The timing mark should be at the appropriate degree before Top Dead Center. (read the manufacturers manual)
15. Perform compression test.

DIESEL ENGINE TUNE-UP (Timing Gear/ C190)

Procedures:

1. Read the Manufacturer's specifications for the Engine.
2. Prepare all of the necessary tools and Personal Protective Equipment (PPE).
3. Check the Engine:
 - a. Battery Voltage
 - b. Oil Level
 - c. Run the engine for 5mins to get to its normal operating temperature.
4. Remove the Cylinder Head Cover.
5. Set the Valve Clearance for each cylinder.
 - a. Diesel Engine: ISUZU C190/ C240
 - i. Both Intake and Exhaust Valves = 0.014"
6. Set the 1st cylinder into Ending of Compression Beginning of power.
7. Remove the fuel lines.
8. Remove the Injection pump.
9. Install the new/ Calibrated Injection pump.
10. Set the timing marks.
11. Install all of the fuel lines.
12. Install the governor vacuum hose.
13. Bleed the Fuel System on the filter lines using the primer pump.
14. Bleed the Fuel System on the injector lines by cranking the engine.
15. Tighten the connections on the injectors when all the air is gone.
16. Turn on the glow plugs to heat the air on the pre combustion chamber for easy starting.
17. Start the engine.
18. Adjust the idle speed using the idle screw if needed.

19.Perform compression test.

20.Never perform wet compression test on a diesel engine.